

AMENDMENTS TO THE CLAIMS:

1-3. (Cancelled).

4. (Previously Presented) An impurity doping method for semiconductor as claimed in claim 28 wherein:

a supply of said first impurity raw material is started in synchronous with starting a supply of said first crystal raw material, a supply of said second impurity raw material is started after finishing the supply of said first impurity raw material, and the supply of said second impurity raw material is finished before starting the supply of said second crystal raw material.

5. (Previously Presented) An impurity doping method for semiconductor as claimed in claim 28 wherein:

there is a period of time wherein said first impurity raw material is supplied with said second impurity raw material at the same time.

6. (Previously Presented) An impurity doping method for semiconductor as claimed in claim 26 wherein:

a crystal raw material supplied precedently within said one cycle in said crystal raw materials is at least one member selected from the group consisting of Ga, Al, In, B, Zn, and Cd, while a crystal raw material is supplied latterly within said one cycle is at least one member selected from the group consisting of N, As, P, S, Se, and Te.

7. (Previously Presented) An impurity doping method for semiconductor as claimed in claim 27 wherein:

a crystal raw material supplied precedently within said one cycle in said crystal raw materials is at least one member selected from the group consisting of Ga, Al, In, B, Zn, and Cd, while a crystal raw material supplied latterly within said one cycle is at least one member selected from the group consisting of N, As, P, S, Se and Te.

8. (Previously Presented) An impurity doping method for semiconductor as claimed in claim 28 wherein:

a crystal raw material supplied precedently within said one cycle in said crystal raw materials is at least one member selected from the group consisting of Ga, Al, In, B, Zn and Cd, while a crystal raw material supplied latterly within said one cycle is at least one member selected from the group consisting of N, As, P, S, Se and Te.

9. (Original) An impurity doping method for semiconductor as claimed in claim 4 wherein:

a crystal raw material supplied precedently within said one cycle in said crystal raw materials is at least one member selected from the group consisting of Ga, Al, In, B, Zn, and Cd, while a crystal raw material supplied latterly

within said one cycle is at least one member selected from the group consisting of N, As, P, S, Se, and Te.

10. (Original) An impurity doping method for semiconductor as claimed in claim 5 wherein:

a crystal raw material supplied precedently within said one cycle in said crystal raw materials is at least one member selected from the group consisting of Ga, Al, In, B, Zn, and Cd, while a crystal raw material supplied latterly within said one cycle is at least one member selected from the group consisting of N, As, P, S, Se, and Te.

11. (Previously Presented) An impurity doping method for semiconductor as claimed in claim 26, wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

12. (Previously Presented) An impurity doping method for semiconductor as claimed in claim 27, wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

13. (Previously Presented) An impurity doping method for semiconductor as claimed in claim 28, wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

14. (Original) An impurity doping method for semiconductor as claimed in claim 4 wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

15. (Original) An impurity doping method for semiconductor as claimed in claim 5 wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

16. (Original) An impurity doping method for semiconductor as claimed in claim 6 wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

17. (Original) An impurity doping method for semiconductor as claimed in claim 7 wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

18. (Original) An impurity doping method for semiconductor as claimed in claim 8 wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

19. (Original) An impurity doping method for semiconductor as claimed in claim 9 wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

20. (Original) An impurity doping method for semiconductor as claimed in claim 10 wherein:

said impurity raw materials are a p-type impurity raw material and an n-type impurity raw material.

21. (Previously Presented) An impurity doping method for semiconductor wherein a crystal layer made of crystal raw materials is doped with impurities, comprising:

a cycle composed of:

a first step wherein a supply of trimethylgallium (TMGa) and biscyclopentadienyl magnesium ((Cp)₂Mg) is started at a first timing, and the supply of TMGa and (Cp)₂Mg is finished at a second timing at which the supply TMGa and (Cp)₂Mg for a predetermined period of time was completed;

a second step wherein a supply of tetraethylsilane (TESi) is started either immediately after, or after the second timing at which the supply of TMGa and $(\text{Cp})_2\text{Mg}$ was finished, and the supply of TESI is finished at a third timing at which the supply of TESI for a predetermined period of time was completed;

a third step wherein a supply of ammonia (NH_3) is started either immediately after, or after the third timing at which the supply of TESI is finished, and the supply of NH_3 is finished at a fourth timing at which the supply of NH_3 for a predetermined period of time was completed; and

a fourth step wherein a purge time is started after the supply of NH_3 is finished at the fourth timing at which the supply of NH_3 was completed, and said purge time is finished at a fifth timing;

impurity pairs being formed as a donor-acceptor complex in said first and second steps using co-doping causing a decrease in activation energy and an increase in carrier concentration in said crystal layer

said first through fourth steps being repeated a desired number of times.

22. (Withdrawn) A semiconductor material prepared by doping a crystal layer with plural types of impurities comprising:

said plural types of impurities being disposed closely with each other in said crystal layer at a predetermined ratio.

23. (Withdrawn) A semiconductor material prepared by doping a crystal layer made of Ga with Mg and Si comprising:

Mg and Si being disposed closely with each other in said crystal layer made of Ga at a predetermined ratio.

24. (Withdrawn) An impurity doping system for semiconductor wherein a crystal layer made of crystal raw materials is doped with impurities, comprising:

a reaction tube to the interior of which is disposed a substrate;

a plurality of pipes for supplying raw material gases of the crystal raw materials as well as for supplying raw material gases of impurity raw materials into said reaction tube, respectively;

gas valves mounted on said plurality of pipes, respectively;

a flow rate setting means for setting out each flow rate of the raw material gases of said crystal raw materials and the raw material gases of said impurity raw materials flowing through said plurality of pipes, respectively, to a predetermined value;

a heating means for heating said substrate disposed inside said reaction tube; and

a control means for controlling closing motions of said gas valves, flow rates set out by said flow rate setting means, heating of said substrate by means of said heating means, and controlling further in such that the raw

material gases of said crystal raw materials and the raw material gases of said impurity raw materials are supplied into said reaction tube through said pipes at predetermined timings, respectively, in a pulsed manner.

25. (Withdrawn) An impurity doping system for semiconductor wherein a crystal layer made of crystal raw materials is doped with impurities, comprising:

a reaction tube to the interior of which is disposed a substrate;

a first pipe for supplying NH_3 gas into said reaction tube together with H_2 gas being a carrier gas;

a second pipe for supplying TMGa , $(\text{Cp})_2\text{Mg}$, and TESi into said reaction tube together with H_2 gas being a carrier gas;

a third pipe for supplying N_2 gas being a carrier gas into said reaction tube;

gas valves mounted on said first, second, and third pipes, respectively;

a flow rate setting means for setting out each flow rate of gases flowing through said first, second, and third pipes, respectively, to a predetermined value;

a heating means for heating said substrate disposed inside said reaction tube; and

a control means for controlling closing motions of said gas valves, flow rates set out by said flow rate setting means, heating of said substrate by

means of said heating means, and controlling further in such that NH_3 gas is supplied in said reaction tube through said first pipe, TMGa, $(\text{Cp})_2\text{Mg}$, and TESI are supplied into said reaction tube through said second pipe, and N_2 gas is supplied into said reaction tube through said third pipe at predetermined timings, respectively, in a pulsed manner.

26. (Previously Presented) An impurity doping method for semiconductor wherein a crystal layer made of crystal raw materials is doped with impurities, comprising:

supplying as one cycle each of said crystal raw materials, one at a time and separated by a purge time; and

supplying each of plural types of impurity raw materials for a given time, where the given time for supplying each of the impurity raw materials are close to each other;

forming impurity pairs as a donor-acceptor complex in said crystal layer from said plural types of impurity raw materials using co-doping to cause a decrease in activation energy and to increase carrier concentration in said layer.

27. (Previously Presented) An impurity doping method for semiconductor wherein a crystal layer made of plural types of crystal raw materials is doped with impurities, comprising:

supplying as one cycle each of said plural types of crystal raw materials, one at a time and separated by a purge time; and

supplying each of plural types of impurity raw materials for a given time, wherein said given times either are at the same time of or after the start of supplying one of said crystal raw materials as well as before starting the supply of other of said crystal raw materials;

forming impurity pairs as a donor-acceptor complex in said crystal layer from said plural types of impurity raw materials using co-doping to cause a decrease in activation energy and to increase carrier concentration in said layer.

28. (Previously Presented) An impurity doping method for semiconductor wherein a crystal layer made of plural types of crystal raw materials is doped with impurities comprising:

alternately supplying as a single cycle first and second crystal raw materials with purge times between the supply of the first crystal raw material and the supply of the second crystal raw material;

supplying a first impurity raw material and a second impurity raw material at given times which are close to one another and either at the same time of or after the start of supplying of said first crystal raw material as well as before starting the supply of said second crystal raw material;

forming impurity pairs as a donor-acceptor complex in said crystal layer from said plural types of impurity raw materials using co-doping to cause a decrease in activation energy and to increase carrier concentration in said layer.

29. (New) The method according to claim 26, wherein said impurity raw materials are placed at a close relationship with each other at a predetermined ratio without incorporating disorder into said crystal layer.

30. (New) The method according to claim 27, wherein said impurity raw materials are placed at a close relationship with each other at a predetermined ratio without incorporating disorder into said crystal layer.

31. (New) The method according to claim 28, wherein said impurity raw materials are placed at a close relationship with each other at a predetermined ratio without incorporating disorder into said crystal layer.

32. (New) The method according to claim 21, wherein Mg and Si are placed at a close relationship with each other at a predetermined ratio without incorporating disorder in a layer of Ga.

33. (New) The method according to claim 26, wherein said impurity raw materials are supplied in a pulsed manner.

34. (New) The method according to claim 27, wherein said impurity raw materials are supplied in a pulsed manner.

35. (New) The method according to claim 28, wherein said impurity raw materials are supplied in a pulsed manner.

36. (New) The method according to claim 21, wherein $((\text{Cp})_2\text{Mg})$ and said TESI are supplied in a pulsed manner.